**3D COMPUTATIONAL TECHNOLOGY IN CRANIAL NEUROSURGERY**

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AIM:

To present our experience in cranial defect reconstruction as well as in planning tumour resection and reconstruction with prefabricated polymethylmethacrylate (PMMA) implants.

Methods:

From October 1st 2015 till February 22nd 2017 a total of 21 patients were operated on in the University Hospital Rebro, Zagreb for cranial defect reconstruction with the aid of 3D print technology. The patients were operated either for reconstruction of large cranial defects as elective cranioplasty surgeries, or as a pre-planned step in tumour surgery when large bone defects of calvaria and anterior skull base were anticipated. The extents of bone defects were in the scale of typical decompressive craniectomies. Outcome in terms of postoperative complication and aesthetic outcome was recorded. Planning of cranial defect reconstruction was based on 1 mm thick multi slice computed tomography (MSCT) head scan of the patients. Custom-made implants were produced using data obtained from head MSCT using computer-aided design and rapid prototyping techniques. Polymethylmethacrylate was used as the reconstruction material and the implant was cast from a MED610 plastic mould (Stratasys, Eden Prairie, Minnesota, SAD). Tumour resection and defect reconstruction was performed by defining the resection margins on the MSCT data. Pre-surgery defined resection margins were translated on to the surgical site by 3D printed template or by neuronavigation.

Results:

Custom made cranioplasty for cranial defect repair was performed on 17 patients and in bone tumour resection and reconstruction on 4 patients. Tumour resection margins were translated to the surgical site by the template in 3 patients and in one neuronavigation was used. Postoperatively, one patient developed subdural higroma and was surgically treated 1 month later. One patient operated for a giant intraosseous frontal meningioma developed pseudomeningocoelae which needed 3 revision of soft tissue and CSFsurgeries. Two patients were diagnosed with fibrous dysplasia and have diplopia postoperatively, unrelated to the cranioplasty procedure.

Conclusion:

We believe that this technology can set new standards in cranial reconstruction and osseous tumour resection and reconstruction surgery.